Volume 14 February, 1928 *Number 2*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubricating Greases: Their Manufacture and Usage

PUBLISHED MONTHLY BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

Foreword

THE question of grease lubrication and its relative adaptability to certain types of mechanical equipment is extremely important. For, just when or where to use grease is frequently a problem, not only to the operator, but also the machine designer. It is more than a question of the original installation of lubricators and the periodic filling of these latter. Operating conditions *must* be considered.

Where the problems of lubrication have received careful study and where the operating conditions and their effect upon lubricants in general have been analyzed, there should rarely be any doubt as to the suitability of the means of lubrication installed by the machine builder, especially on modern equipment. If he advises the use of grease (and perhaps specifies products of certain consistencies and oil content), these should be adhered to by operators unless actual experience clearly shows the wisdom of changing over.

On the other hand, certain machinery, particularly if at all out-of-date, will always merit attention and a check-up as to the proper lubrication of the wearing elements. Too frequently an oil cup will be found where operating conditions would manifestly require grease.

Take the matter of high temperature service, for example. Here greases specifically designed for effective and economical lubrication under such conditions would usually be far more suitable than oils. And yet, very frequently, the use of oil is compulsory due to the character of the lubricating devices installed.

Accordingly, the following article has been prepared to deal with this broad subject of grease lubrication. The purpose is to give a better understanding of:

How the essential types of greases are manufactured,
Their characteristics and the methods of test,
The operating factors which influence their choice,
The salient advantages and disadvantages,
Where and when such a lubricant should be used,
And the customary means of application.

This discussion is presented with the feeling that a more intimate knowledge of this important subject will lead to that higher degree of operating efficiency which directly follows effective lubrication.

THE TEXAS COMPANY

Texaco Petroleum Products

Dept. H, 17 Battery Pl., New York City

Atlanta
Boston
Chicago
Dallas
Denver
Houston
Jacksonville
Minneapolis
New Orleans
New York
Norfolk
Oklahoma City
Spokane

LUBRICATION

A Technical Publication Devoted to the Selection and Use of Lubricants

Published Monthly by

The Texas Company, 17 Battery Place, New York City

Vol. XIV — February, 1928 — No. 2

Change of Address: In reporting change of address kindly give both old and new addresses.

Lubricating Greases: Their Manufacture and Usage

IN the attainment of effective lubrication of practically any machine, much will depend upon the adaptability of the lubricants to the means of application and to the prevailing operating conditions.

This will involve detailed knowledge of the physical characteristics of such products as may be under consideration, if they are to ultimately function as intended.

Straight mineral lubricating oils are perhaps more fully understood than greases or other products which are of a compounded nature. The reason is, perhaps, that there is not the possibility for as wide a variation in the different types, and the physical characteristics such as viscosity and pour test by which they are commonly selected, have been standardized and rendered capable of checking in a ready and practicable manner.

In the case of greases, on the other hand, properties such as hardness, melting point, consistency and color may frequently be ambiguous to many, and are very often difficult to check or even define.

As a result, it is felt that the manufacture of greases and their function as lubricants are well worthy of discussion, for when and where to use grease is one of the prevailing problems in industrial plant lubrication today.

The innumerable moving parts of modern machinery which will involve friction have brought about an evolution in grease lubrication and manufacture, with the lubricating engineer, petroleum chemist and grease maker as the controlling factors.

The great number of products on the market today termed greases are so varied that it is almost impossible to give a definition of grease which will be satisfactory to all. The most generally accepted idea as proposed by the American Society for Testing Materials regards it as "a combination of a petroleum product and a soap or a mixture of soaps, suitable for certain types of lubrication."

The characteristics and qualities of any such product will depend upon:

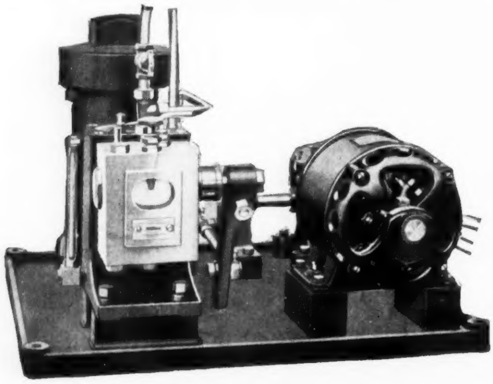
(1) The animal or vegetable oil used.
(2) The alkali used to saponify the fat.
(3) The amount of water incorporated.
(4) The method of manufacture, and
(5) The rate of cooling the finished product.

The manufacture of good lubricating greases depends upon the science of the chemist and the skill of the grease maker. Of course, if the grease maker is a chemist he can combine his technical and practical training towards the development of a more highly perfected product. However, if uniform products are to be continually manufactured from day to day, the grease maker must not only be highly proficient, but must be constantly alert. In fact he must know his greases so well that at various stages in the manufacturing process, he can judge whether or not the batch is up to standard, and he must anticipate just what the product will be as regards color, texture and hardness two or three days after the grease is drawn.

Greases are no longer considered as lubricants in which the by-products of the oil industry are worked off. All raw materials entering a grease are subjected to rigid specifications, and many of the most highly refined oils are used.

How Greases Are Made

By varying the raw materials and method of manufacture, greases may be produced in many grades, each having specific characteristics. In turn, by varying the soap content but otherwise using the same materials, a number



Courtesy of S. F. Bowser & Co., Inc.
Fig. 1—A motor driven grease lubricator of the positive pressure type. Such a device is adaptable for forcing of grease to submerged bearings on pumps and vertical water wheels.

of greases may be manufactured having the same characteristics. Products of this nature that are manufactured by the same process and are applied to the same general class of work, are usually classified under what is known as a grease series. Cup Grease is the best example of a grease series.

Generally, however, greases are classified according to the kind of soap base used in the manufacture of the product. Under this classification we have:

I. Lime Base Greases:
   (a) Cup Greases
   (b) Sett Greases
II. Soda Base Greases
III. Specialty Greases

LIME BASE CUP GREASES

The various products used as lubricants termed Cup Greases vary from a virtual oil of low viscosity to a distinctly hard grease. They are emulsions of mineral lubricating oil and water stabilized by calcium soap. Since lime soap is more soluble in mineral lubricating oil than in water, the external phase is considered to be the mineral lubricating oil, whereas the dispersed phase is water.

Materials Used in Cup Grease Manufacture

The selection of raw materials with which to manufacture Cup Greases is very important. If a grease with the desired melting point, color, odor and texture is to be manufactured a definite fat or fats must be selected. Furthermore, the lime used should be of the highest quality.

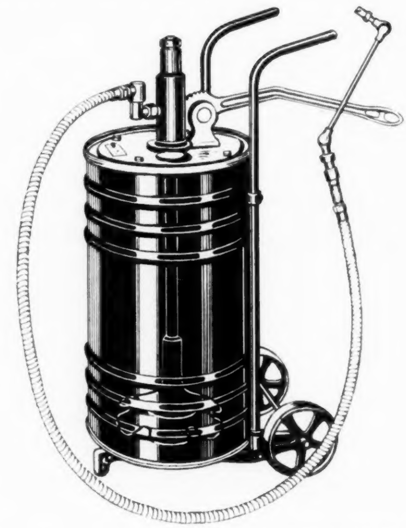
The most commonly used fats are horse fat, lard or lard oil, tallow, cottonseed oil, stearic and oleic acid. A combination of the above fats as well as others is often used in order to increase the speed of the reaction as well as to impart other desirable characteristics.

Hydrated lime is the most common form used as the saponifying agent. This should be of the highest quality and uniform in strength, that is, content of available calcium oxide.

The mineral oil which constitutes the bulk of the grease should be carefully selected, preferably of a viscosity suitable for the bearing conditions to which the grease is to be applied.

Viscosity of Mineral Oil Important

The viscosity of the mineral oil used in the manufacture of Cup Greases is also very important. Mineral oils of the proper viscosity for particular conditions should be used. The



Courtesy of Safety Lift Co.
Fig. 2—Details of a drum type grease compressor or gun showing construction and arrangement of fittings.

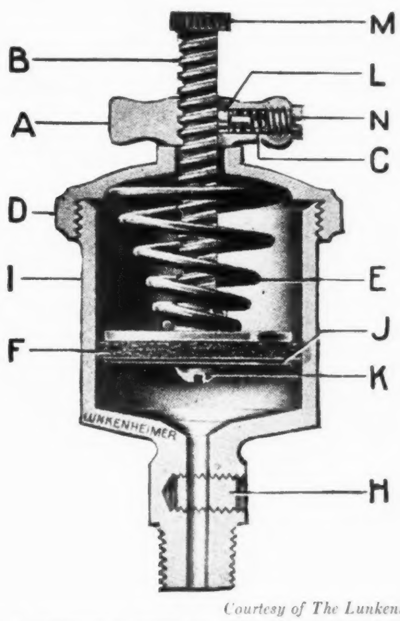
majority of Cup Greases on the market today are manufactured with low viscosity lubricating oils. There are certain types of pressure greases and bearing greases, however, which require high viscosity lubricating oils.

Method of Manufacture

Lime water and animal or vegetable oil are charged into a steam jacketed kettle and the mixture heated for several hours. During the process of heating, saponification takes place, excess water is evaporated, and the resulting product is a hard soap. At this point mineral oil is incorporated and enough water added to form a stable emulsion.

The product must now be brought to test for consistency and the skill of the grease maker is put to test. Since the grease is drawn while hot it must be anticipated just what the consistency and texture will be the following day. If too much water is present the grease will be dull and cloudy; if not enough water is present, the grease will be granular. Therefore, in order to obtain a bright transparent grease the correct percentages of raw materials must be added while the grease is in the kettle, for when once drawn into containers it is then too late to make corrections. The resulting product should be bright, having a buttery texture, and the emulsion should be stable enough so that no oil will separate from the grease while in storage.

A small amount of dye is sometimes added to



Courtesy of The Lunkenheimer Co.

Fig. 3—A compression grease cup of the automatic feed type. "F" is a leather packed plunger, under pressure of a steel spring "E". The regulating screw "H" controls the delivery of lubricant into the bearing. "A" is the control handle, "B" the plunger stem, and "L", "C", and "N" a spring locking mechanism to prevent alteration of plunger adjustment, due to vibration.

Cup Greases in order to maintain a uniform color.

Since Cup Greases are lime soap products, they are insoluble in water and can, therefore, be subjected to weather conditions. It must be remembered when applying Cup Greases to their various fields of application that the product cannot be subjected to conditions which may melt the grease. Should the water present in the grease be evaporated, the emul-

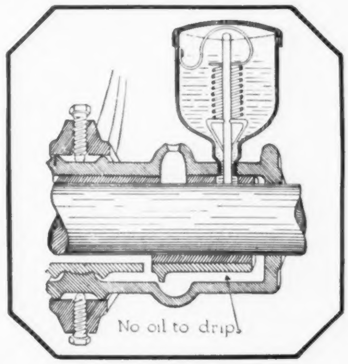


Fig. 4—The Knoor spring type grease lubricator. This device is entirely automatic in action, functioning only when the shaft is in motion.

sion will be destroyed and the mixture on cooling will not return to its original condition.

Sett Greases

Sett Greases may be defined as greases which contain various grades of mineral lubricating oils, and calcium soaps of rosin acids. They are manufactured by mixing at low temperatures, mineral oil, rosin oil, and sett. The sett is an emulsion consisting of lime, mineral oil, water, and a small quantity of rosin oil. The rosin oil reacts with the lime, forming a small quantity of rosin soap, which stabilizes the emulsion.

The major portion of the mineral oil and rosin oil is mixed in one container and the sett in another. When the ingredients of each container are united the final mixture will solidify in a few minutes. The resulting product will be a satisfactory grease providing the ingredients were mixed in the correct proportions and the method of procedure carefully carried out.

Sett Greases have higher melting points than Cup Greases, and are insoluble in water. They are less expensive lubricants to manufacture than most greases, and are satisfactory for rough lubrication, such as on heavy bearings operating at slow speed, wagon axles and street railway track curves.

The most commonly used sett greases are:

I. Axle Greases.
   (a) Light Axle Grease
   (b) Graphite Axle Grease
II. Curve Greases

Axle Greases

Light Axle Grease is manufactured with a low viscosity mineral lubricating oil, whereas Graphite Axle Grease is manufactured with a

higher viscosity mineral lubricating oil, and flake graphite or mica. The latter ingredients are advantageous on account of the poor mechanical conditions often experienced on wagon

Courtesy of The Bassick Mfg. Co.
Fig. 5—Showing the use of the hand grease gun for the lubrication of the bearings on excavating machinery.

axles and on other slow speed, low pressure bearings.

Light and Graphite Axle Greases usually have a consistency similar to that of Cup Grease No. 3. They have been found to be very satisfactory for the lubrication of wagon axles. They have also been found to give satisfactory lubrication on bearings subjected to water.

Curve Greases

Curve Greases are prepared in a manner similar to other sett greases, the nature of the mineral oil content being varied to suit conditions.

SODA BASE GREASES

The description given of lime base greases applies in a general way also to soda base greases. The colloidal condition is, however, entirely different in those which contain water; here an emulsion of the oil in water type exists. Many soda base greases are, however, completely dehydrated and are, therefore, not emulsions, but intimate mixtures of soap and oil.

Method of Manufacture

Caustic soda solution of proper strength, and the fat or fatty oil are charged into the grease kettle and saponification takes place. In some cases, the fat is first mixed with all or part of the lubricating oil and saponification is brought about by boiling the mixture after addition of the required amount of caustic soda.

Sponge or Fiber Grease

Sponge Greases or fiber greases are soda base products of medium consistency and high melting point. The fiber texture of the grease depends upon the degree of dehydration of the soap and the method of mixing. Since these products have a soda base which is water soluble they cannot be used where there is possibility of contact with water.

Two Possible Types

There are two types of fiber greases in use, one manufactured with a pale mineral oil of low viscosity, the other with a heavy cylinder stock. The latter mineral oil, together with the fibrous texture makes the product very tenacious, and hence a very suitable grease for gear and bearing lubrication.

Caustic soda solution of known strength, and tallow or other fats are agitated in a steam jacketed kettle until the mixture is completely saponified. At this point, practically all of the water has been evaporated, so the mineral oil may be added in small quantities. Heating is continued until the soap and oil emulsify readily. The oil is added slowly until the desired consistency is obtained.

SPECIALTY GREASES

There are many types of bearings and moving parts of machinery having conditions such that none of the above lubricants may be used, so it is often necessary to have a specific lubricant for a definite service. This accounts for so many specialty greases being on the market today. The most important products under this classification are:

Wool Yarn Greases and
Greases for Tube Mills and Cement Plants.

Wool Yarn Grease

This is a soft soda soap grease containing approximately 10 per cent of wool waste.

The soda soap grease is manufactured exactly the same as sponge grease, only to a much softer consistency. The product is drawn into barrels and then mixed with the wool waste, either by hand or by mechanical agitation.

Bearing Grease for Tube Mills and Cement Plants

This is usually a soda soap grease having a much higher melting point than sponge grease. The texture of it is not similar to fiber grease, but is of a short, buttery consistency. This product has been found to be an excellent

product for lubricating the bearings on tube mills in cement plants, where bearing temperatures in the neighborhood of 200 degrees F. are maintained.

Caustic soda solution, tallow or other fats, and mineral oil are saponified in a fire heated kettle and the mixture dehydrated. The grease is drawn while hot and allowed to cool.

The quality of this product depends to a great extent upon the skill of the grease maker. He must anticipate the characteristics of the grease before the batch is drawn, for after the grease is removed from the kettle it is not known until 24 hours later whether or not the product is up to specification.

The resulting grease is used for packing journal boxes of the open type and has been found to be very satisfactory.

Characteristics of Greases and Methods of Testing

HARDNESS

The hardness of greases may be considered in most cases to be a measure of the soap content. This is especially true of greases of the same series, the hardness being in direct proportion to the percentage of soap present.

Factors which control the hardness of a grease are:

(1) Character of fatty oil used.
(2) Percentage of free fats in the final product.
(3) Percentage of free alkali in the final product.
(4) Rate of cooling.
(5) Method of manufacture.
(6) Drawing temperature.

The selection of fatty oils of animal or vegetable nature is of tremendous importance in manufacturing greases. Some fatty oils will make harder greases than others which accounts for the fact that some greases having the same hardness do not contain the same percentage soap. Of course, other factors, such as, rate of cooling, method of manufacture and composition of final product also influence the hardness, but these can easily be controlled.

The rate at which a grease is cooled is very important. For example, Cup Grease can be manufactured to a consistency of Cup Grease No. 3, or, by cooling rapidly, can be brought to the consistency of Cup Grease No. 1.

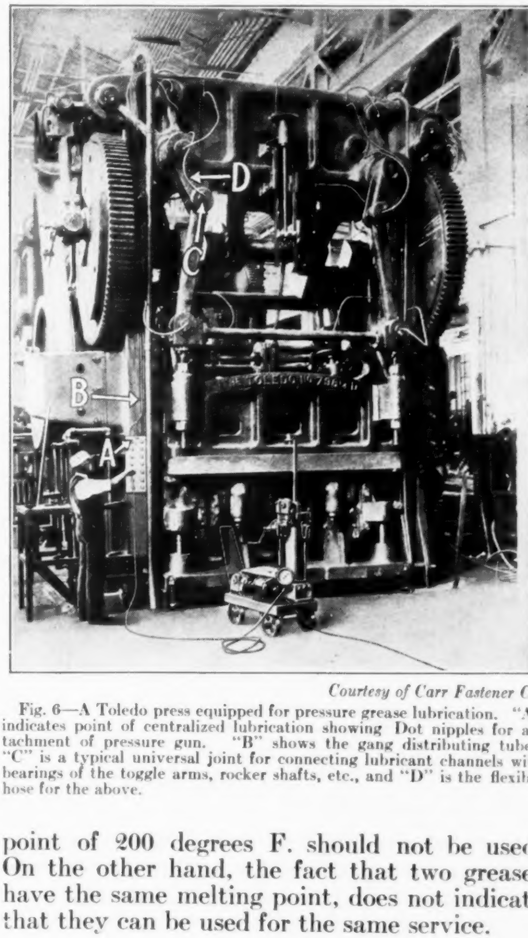
Method of Testing Grease for Hardness

The American Society for Testing Materials, has devised and adopted the only method which is at all satisfactory from a comparative viewpoint, for determining the hardness of greases.

The apparatus consists of a cone-shaped plunger of definite weight, which is attached to a pointer. The distance the cone penetrates the grease is indicated by the pointer on a disc graduated in decamillimeters, which in turn is a measure of the hardness. For example, the majority of cup greases having a consistency of Grease No. 3 have a hardness ranging from 180 to 220.

MELTING POINT

The melting point of a grease is one of the controlling factors for grease lubrication. It is quite obvious that if the bearing temperature is 250 degrees F. a grease having a melting point of 200 degrees F. should not be used. On the other hand, the fact that two greases have the same melting point, does not indicate that they can be used for the same service.

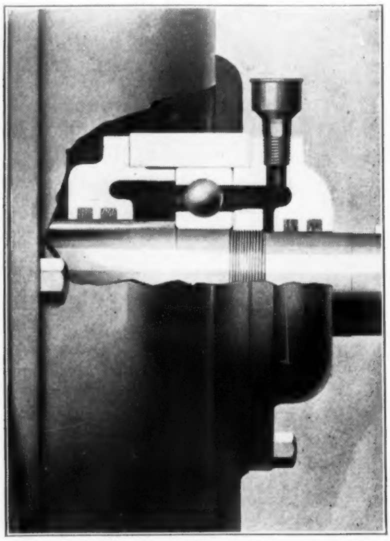


Courtesy of Carr Fastener Co.

Fig. 6—A Toledo press equipped for pressure grease lubrication. "A" indicates point of centralized lubrication showing Dot nipples for attachment of pressure gun. "B" shows the gang distributing tubes. "C" is a typical universal joint for connecting lubricant channels with bearings of the toggle arms, rocker shafts, etc., and "D" is the flexible hose for the above.

The melting point of a grease is controlled by:

(1) The character of fatty oil used,
(2) The character of alkali used, and
(3) The percentage of soap present.



Courtesy of Reliance Electric and Engineering Co.

Fig. 7—Ball bearing of an electric motor being lubricated by means of a screw-down compression grease cup. Note space available for grease retention.

The character of the alkali used, whether lime, caustic soda or other material influences the melting point more than the other factors. For example, lime greases are low melting point products, whereas, caustic soda greases are high melting point products.

The "Drop Test" is more commonly used for determining the melting point of greases, than any other test. A small amount of grease is placed on the bulb of a thermometer and suspended in a test tube. The tube is slowly heated and the temperature at which the grease melts and drops off the bulb of the thermometer is taken as the melting point of the product.

CONSISTENCY

By consistency is meant the characteristics of the texture of the grease. For example, cup greases usually have a short fibery, buttery consistency whereas sponge greases have a long fibery, spongy consistency.

In selecting a grease for a definite type of lubrication it is essential that the consistency be carefully considered. It should be decided whether the grease should have a fibery or buttery texture and whether or not it is advisable to use a dehydrated grease. Effective lubrication and minimum consumption will, therefore, depend to a great extent upon the consistency of the grease.

COLOR

The color of a grease indicates to a certain extent the quality of the constituents of the grease. However, due to excessive manufacturing temperatures, a grease may be very dark and yet contain highly refined products. Greases of the same grade will have uniform colors providing the method of manufacture has been carefully carried out. Cup greases, as mentioned above, are slightly colored in order to make them bright yellow.

No method of testing grease for color is used other than by observation.

ODOR

The majority of animal fats used in grease manufacture have objectionable odors and even after the fats are saponified, they may at times be detected in the resulting grease. For this reason, some of the most highly refined greases are flavored, such as cup greases. Then too, greases that are perfumed may be more easily identified by consumers. Nitro-benzene is the most commonly used deodorizer which changes the objectionable fat odors into the more pleasant odors of Oil of Myrbane.

Operating Factors Which Influence Choice of Grease

Where and when to use grease will depend to a considerable extent upon conditions of operation and the design of the equipment to be lubricated. Frequently, it may be impossible to use oil, by reason of prevailing temperature, pressure or constructional details.

As a general rule, grease should be used:

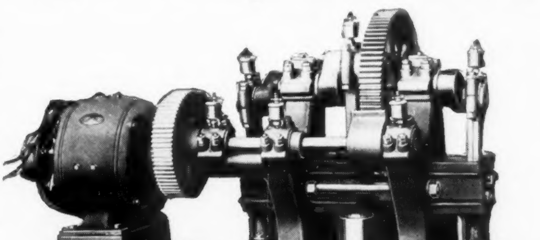
1. When oil cannot be retained in and around the bearing, due to "squeezing out" caused by high pressure, slow rubbing speed or high operating temperature.
2. In cases where any liability of oil splash or drips would involve damage to belting or the materials being handled by the machine, as for example in the textile mill.
3. Where the bearing may be subject to repeated shocks as on the motor car chassis, which would tend to break the lubricating film.

4. Where it is desirable to insure positive lubrication using a comparatively small amount of lubricant, and yet have a sufficient reserve to enable the part to operate with relatively little attention for a considerable length of time. This particularly applies to inaccessible bearings where gravity feed grease cups are used, which would otherwise entail shutting down of the machinery for attention.
5. Where relatively high operating temperatures are encountered.
6. Where it is desirable that the lubricant retain its position by virtue of its physical characteristics whether the machine is idle or in motion, such as in locomotive driving journal lubrication.

Wherever speeds are relatively high and oil can be effectively applied and retained by the bearing, grease lubrication should not be used unless other exceptional conditions warrant it, inasmuch as bearing temperatures and power consumption may be increased. Nor should greases be used where contact with steam may be possible and the exhaust steam returned to boiler feed.

The type of equipment available for feeding greases to the parts to be lubricated will also be a factor in determining when and where to use such lubricants.

The choice of a grease for any particular service, the hardness and melting point, are usually taken as the governing characteristics.

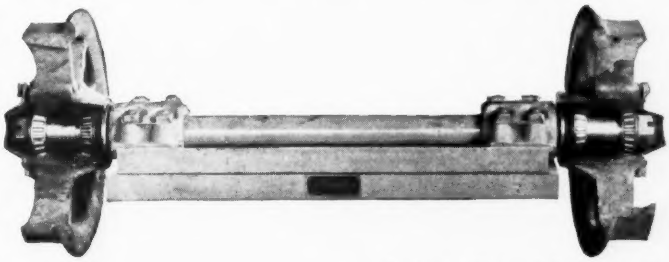


Courtesy of Platt Iron Works.

Fig. 8—Grease lubrication applied to the bearings of a vertical triplex pump, by means of compression grease cups. Here relatively high pressure and moisture conditions may frequently prevail, accompanied by wide temperature variations.

For instance, cup greases are designed for compression grease cup or pin cups on bearings where little frictional heat is necessary to make the lubricant flow.

Where investigation shows the operating temperatures or pressure to be relatively high, the melting point and hardness of the grease used should be proportionally higher. Under



Courtesy of Timken Roller Bearing Co.

Fig. 9—Sectional view of a car wheel axle and bearings. Note that these latter are of the tapered roller type. Grease lubrication in such service will usually prevail.

extreme pressure and temperature conditions as in railroad locomotive service a relatively solid grease would be necessary, which can be applied in cake form to the bearing.

ADVANTAGES OF GREASE AS A LUBRICANT

In a comparison of grease with oil from a lubricating point of view consideration of machinery details and the relative adaptability of each lubricant for the service intended is essential.

The question of where and when to use grease as a lubricant, therefore, requires an intimate knowledge of machinery operation and the science of lubrication.

There are certain definite characteristics possessed by greases which tend to give them decided advantages in many cases. Theoretically grease lubrication is best suited to low speed service. By virtue of the fact that a grease film is normally thicker than an oil film (at low operating speeds) due to its generally greater body, the rate of distortion in the film will be less. It is uncertain whether this condition would hold under higher shaft speeds, however, since the questions of pressure, bearing area and means of applying the lubricant would, by their effects, render each case individual in its operation.

Another advantage grease lubrication presents is the usual total freedom from splashed or dripped lubricants. In certain types of machinery introduction of the lubricant to the product being handled will practically ruin the latter; as for example, in the Textile and Baking Industries.

Means of lubrication on much of the equipment used therein renders cleanliness of the bearings and other wearing parts practically impossible were oil to be used. Hence, grease is resorted to, being applied by compression

type grease cups, some form of pressure gun via suitable fittings, or by pin type cups.

DISADVANTAGES

In view of the fact that greases are chiefly of advantage in lubricating slower speed high-pressure units wherein a relatively thick film of lubricant is desirable, it can be inferred they will be disadvantageous under high speed conditions.

There has been extensive effort in certain technical articles and advertising bulletins to promote the use of grease by decidedly ambitious statements as to its qualifications. In fact, such propaganda would very frequently lead the layman to believe that a grease is a "cure-all" wherever a lubricant is required. The use of grease, however, is clearly limited to the lubrication only of such points as are favorable to its application.

The most decided disadvantage pertinent to the use of grease is the possibility of lack of stability. Unless grease is skillfully and scientifically mixed, and the highest grade of ingredients used there will be a marked tendency towards lumpy separation of the oil and soap constituents. This occurrence will be especially likely if the grease is stored over any length of time.

Separation may be caused by use of excess heat in mixing such products as cup and sponge greases, or by improper handling. For example, if the grease maker is not an adept at his art, frequently he will overheat the batch in an endeavor to brighten it.

Typical Instances of Grease Lubrication

MINE CAR BEARINGS

In mine car service, soft or semi-fluid lime-soap greases are usually recommended for roller bearings. Where the latter are of solid,

Courtesy of Lincoln Steel & Forge Co.

Fig. 10—Greasing mine car wheel bearings is frequently a sloppy, tedious job, unless carried out by some form of automatic pressure lubricator as above.

cylindrical or tapered construction a somewhat more inert grease will be advisable, than on hollow flexible bearings. It will be found that such a product will furnish a better cushion between the axle and rollers than a more liquid grease. Furthermore, it will also form a better seal against possible entry of dust or dirt.

For flexible roller bearings, however, the lubricant should be a semi-fluid or so-called liquid grease. The usual construction of such bearings provides for the hollow spaces within the rollers serving as grease reservoirs.

In consequence the lubricant must be sufficiently fluid to readily pass through and penetrate to all the surfaces of contact. It should never remain inert within the rollers. Furthermore its oil content should always have a sufficiently low pour test to insure against undue congealment in cold weather.

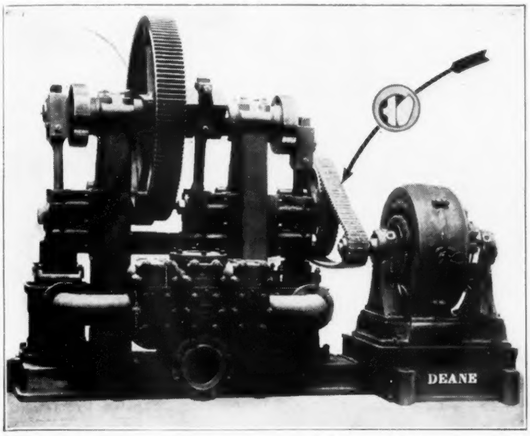
Properly lubricated roller bearings which are constructed of a relatively oil and dust-tight nature should not require re-lubrication more frequently than every four to six months. The lubricant should be applied by a pressure gun of capacity commensurate with the proper amount of lubricant per bearing. In this way just the right amount, as recommended by the manufacturers, can be injected, with the least possibility of subsequent leakage or development of abnormal internal friction.

INDUSTRIAL TRUCK GEARING

In the case of semi-fluid greases, or transmission lubricants which are soap-thickened oils, such as are intended for service on final drive gearing of industrial trucks, there will be the possibility of separation of the oil from the soap or carrier, wherever a truck must operate under abnormally high temperature conditions. Where greases of inferior or questionable manufacture are involved this will be all the more true. Only the most careful preparation can

insure against separation in a grease, when it must be subjected to wide variations in temperature, or lengthy storage.

For this reason soap-thickened transmission lubricants must be selected with even greater care than other products for such service. It is added proof of the advisability of at least monthly inspection of such a lubricant in the final drive housing to ascertain its ability to withstand the service involved, the possible degree of separation which may have occurred and the extent to which replenishment may be necessary.



Courtesy of Morse Chain Co.

Fig. 11—A motor driven pump. The chain drive used in this installation by virtue of its construction and exposed location should be grease lubricated, by a lubricant of sufficient pliability to penetrate to the link connections as shown, but of adequate texture and adhesiveness to resist being thrown off when the chain is in motion.

DEEP WELL PUMPS

Deep well pumping equipment will also be of interest. Under conditions of marked difference in head, especially where automatic circulation of oil is not provided for or where the oil might exert a pressure on the openings around the bottom bearings so much greater than would the water in the well (particularly when the pump is not operating) this oil would run out at the bottom between the shaft and cover pipe. This will be especially true where the stuffing box is worn to any extent. The procedure in such a case is often to resort to a grade of lime-soap grease of the Cup Grease Series which will not only be capable of giving adequate lubrication with as low a drag as possible, but also will have sufficient body to resist the unbalanced pressure which may be involved, and possess the advantage of insolubility in water.

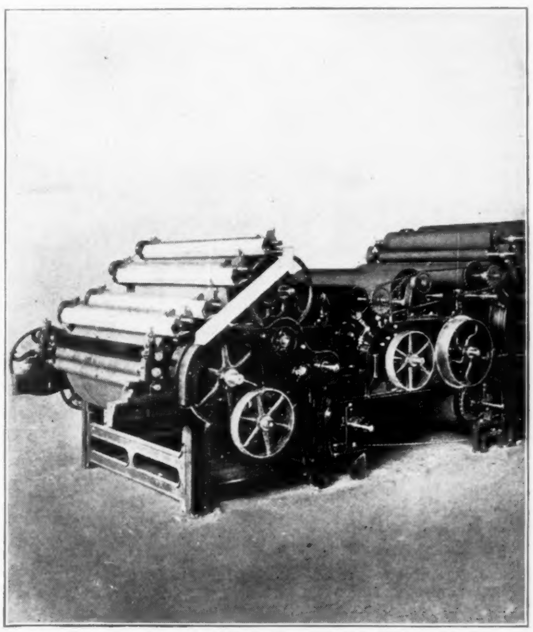
As wear on the stuffing box increases, it may in turn be necessary to use a heavier grade of grease though of course this may involve the sacrifice of a certain amount of mechanical efficiency. Such a grease should have a consistency very nearly the same as that of vaseline, and should be a product which will retain its plasticity at the approximate temperatures of pumping.

WORSTED CARDING MACHINERY

The carding machine presents a distinct lubricating problem in the textile mill, by reason of the construction and motion of its comb box. On such machinery, the action of the doffer comb is vibratory, this reciprocating motion being brought about by a suitable cam or eccentric mechanism.

These eccentric mechanisms run in a bath of lubricant. Due to the fact that the comb is usually set with but a few thousands of an inch clearance between itself and the doffer cylinder, it is absolutely essential that the comb box be kept at an even temperature to insure maintenance of this distance and even running of the sliver.

The successful lubrication of this box has always been a potential problem. Perhaps this has been chiefly due to the fact that textile engineers have in the past been more or less in the dark as to the proper lubricant to use. Many have regarded a semi-solid grease or a fairly viscous oil as the proper lubricant. But with such greases and high viscosity oils it will be difficult to secure the low frictional temperatures which are so necessary.



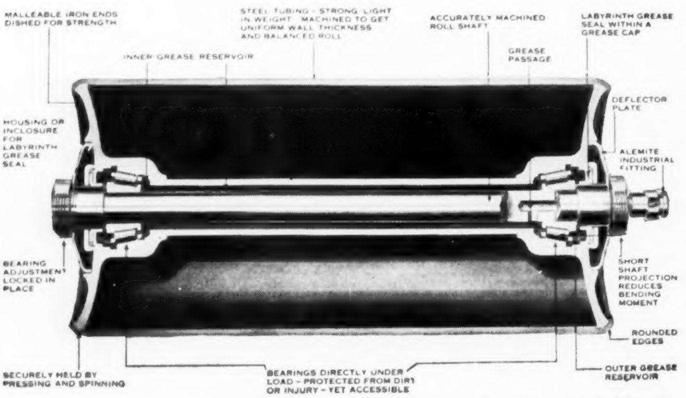
Courtesy of Hyatt Roller Bearing Co.

Fig. 12—A worsted carding machine equipped with grease lubricated flexible roller bearings on the main and breast cylinders.

The probable reason for this inherent preference of heavier or more viscous lubricants has been the necessity for preventing splashing

or throwing from the comb box where it is subjected to the continued churning action of the cam or eccentric mechanism.

Experiments with such equipment, however, have developed that the use of a lower viscosity lubricant will promote lower frictional temperatures and insure the maintenance of a more uniform clearance between the comb and doffer cylinder.



Courtesy of Link Belt Co.

Fig. 13—Details of an anti-friction belt conveyor idler roll. The respective parts are clearly shown, as is the provision for sealed lubrication.

Such a lubricant should be of the nature of a light liquid grease. The soap content will give the requisite texture to prevent splashing or throwing, while the actual lubricant in the form of a relatively light mineral oil will result in the minimum of frictional temperature.

Throwing and splashing of lubricants from the comb box is important in carding, due to the fact that the leather backing of the card clothing is susceptible to deterioration when spotted with mineral oil.

ANTI-FRICTION BEARINGS

In the choice of lubricants for anti-friction bearings of electric motors, for example, wherever there is possibility of oil leakage, or under conditions of dust, dirt or dampness, it may be advisable to resort to grease as the lubricant.

Greases furnish better seals against the entry of dust, dirt and moisture thereby serving to protect the polished surfaces of the bearing elements in a very satisfactory manner.

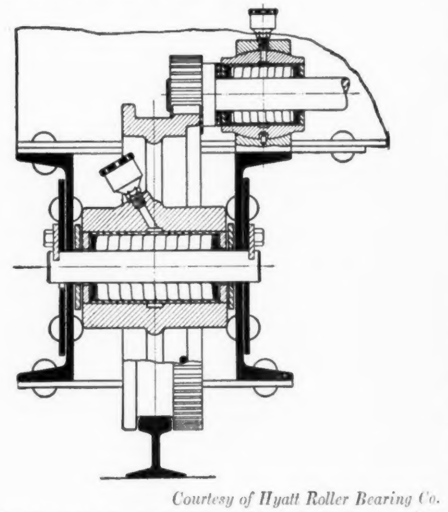
Grease also can be very much more effectively retained in a non-oil-tight housing; on the other hand, dirt or grit that finds its way into a grease lubricated bearing, has no means of settling out, but is always held in suspension, being carried back into the bearing repeatedly.

As a general rule, lime base greases which are comparatively fluid in consistency will meet average operating conditions where the lubricant must readily cover the entire surfaces of the balls or rollers and not tend to channel in the housings or raceways, as might occur with more viscous products of this nature which would have less of a penetrative ability.

On the other hand under conditions of high temperature as for example in the case of certain steel or cement mill motors, it might be necessary to resort to a soda base grease of greater body to withstand the thinning-out effects of heat, and prevent the consequent entry of dust or dirt.

Greases for ball and roller bearing lubrication should be as free from acid forming tendencies as possible in order to insure adequate protection of the highly polished metallic surfaces. In effect this involves perfect neutrality, and of course the absence of fillers. The presence of any material that might give rise to oxidation and the development of free acidity, or to decomposition or settling is also prohibited. Properly compounded products will meet these requirements satisfactorily under normal conditions of operation, and there should be practically no tendency for them to cause corrosion or pitting of balls, rollers or raceways.

Whatever the lubricant specified, in general, a properly designed ball or roller bearing will require replenishment of this product but once every four to six months, or oftentimes at less frequent intervals if the housing is capable of holding a relatively large volume of lubricant, and an effective seal is maintained.



Courtesy of Hyatt Roller Bearing Co.

Fig. 14—Details of the bearings of the bridge wheel of a traveling crane. Note provision for grease lubrication by means of compression cups.

BEARINGS OF ELECTRIC CRANES, ETC.

The bearings of certain types of bulk materials handling equipment will be an especially adaptable field for grease lubrication.

It is always necessary for the means of

lubrication to function relatively automatically and be capable of withstanding the hard knocks so prevalent in such service. As a result the grease cup or pressure gun fitting is extensively used on many of the shafts and sheave bearings of the electric crane, unloader and other equipment of this nature. In many cases, such bearings are located in dangerous and inaccessible positions, where regular oiling, or the filling of oil cups, etc., would be comparatively difficult or even impossible without complete shut-down.

Grease lubrication by means of the hand or spring regulated compression cup or the relatively automatic pin type of cup is, therefore, regarded by many engineers as an effective means of keeping such bearings operating with a minimum of care and the least amount of danger to the operators. Where hand regulated compression cups are involved it requires but a moment for the operator to reach in and screw down the regulator. Usually this can be done with but little danger while the machine is in motion. On more inaccessible parts, however, an automatic spring pressure or pin type cup will even eliminate this necessity, requiring attention only when it is to be refilled or cleaned.

By reason of the fact that some lubricators may often become clogged, especially when functioning in an atmosphere of dust and dirt, it is advisable to inspect regularly, cleaning them where necessary and flushing the bearings to prevent accumulations of foreign matter therein. This, of course, can be carried out with perfect safety, when the machine is shut down. A properly constructed, tightly covered grease cup should, however, effectively prevent the entry of excess dust and dirt via the oil ways, and the film of grease at the outer edge of the bearing should keep foreign matter from penetrating at this point.

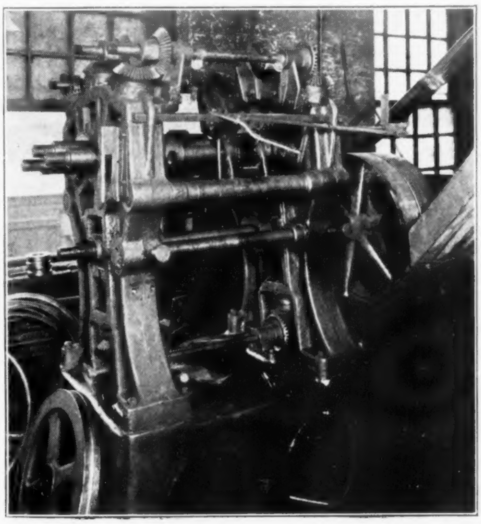


Fig. 15—Wherever exposed gears and plain bearings are involved, grease will oftentimes be the most economical and adaptable lubricant if it is of a nature to meet the operating conditions that may be present.

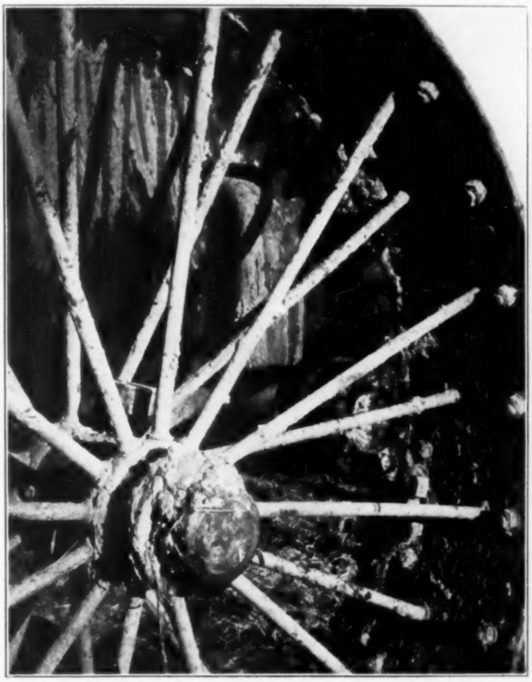


Fig. 16—An example of the intensive service which a grease cup must often do. To effectively lubricate the axle of such a wheel, and resist the abrasive effects of mud, and dirt, and the washing out effects of water, will frequently be a decided problem.

Selection of the Lubricant

Under such conditions the selection of suitable greases is most important. However adaptable may be the means of lubrication, it cannot be depended upon if greases unsuited to usage therein are employed. The essential factors requiring consideration in this regard are insolubility and consistency.

Inasmuch as such lubricants must frequently function under water conditions, they must of course be compounded from the highest grades of mineral oils and insoluble lime soaps. We can readily appreciate that the use of water-soluble soaps in particular might easily lead to imperfect lubrication due to the impairment of the body of the grease and premature flow of the lubricating oil through the bearings. The soap constituent is the carrier for the oil, and as such must retain it in a perfect state of mixture, to be capable of feeding it to the bearings according to their requirements.

The requisite consistency of grease to use will in turn be dependent upon the type and size of the bearings, the pressure involved and the variety of greasing device used. Compression cups will, in general, function best on

relatively solid greases. Pin type cups, on the other hand, involving either temperature or a certain pumping action in the attainment of flow of the grease will require products of lighter consistency.

It is relatively impossible to make specific recommendations in this regard. Operating conditions, machine design and construction, temperatures involved and the class of labor available will all be prone to exert too marked an influence.

AUTOMOTIVE CHASSIS LUBRICATION

Pressure grease lubrication has been extensively adapted to lubrication of the chassis parts on the modern automobile, motor truck and motor coach.

The principle involved is largely that of periodic renewal of the lubricant by means of adequate pressure commensurate with the consistency of the former. Re-charging of certain bearings with grease in this manner should be largely controlled or regulated by the outflow from the ends of the bearings.

In other words, grease is forced through the clearance spaces and bearing grooves (if any are provided) until a fresh film or emission appears at the furthermost exterior parts of the bearings. On the average chassis part, this is possible due to the fact that the steering gear bearings, spring shackle bolts, etc., are not of oil tight construction in the true sense of the word.

Such a condition facilitates the matter of grease lubrication by indicating when bearings have had enough, and also it enables the ready forcing out of deteriorated, contaminated or gummed grease, which otherwise would be a decided hindrance to effective lubrication. This is, in fact, one of the essential advantages of grease lubrication by means of pressure lubricators.

Equipment Involved

For this purpose lubricators of both the mechanical and air pressure type are used. For the handling of products, such as lighter greases, the hand or mechanical pressure gun, or the garage lubricator, which is operated by hand or foot pressure, is in general perfectly satisfactory.

Lubricant Adaptable

Considerable study and research has been given to this matter of pressure grease lubrication of late, and products have been developed which, by virtue of their lubricating characteristics and the nature of the soap content, are distinctly suited for the purpose in view.

Such lubricants possess certain very marked advantages over cup grease, viz.: They are soft, pliable and plastic, and yet with decided non-fluid tendencies. Furthermore, they are able to form and maintain their own housing and capable of "training," or adhering both to wearing surfaces as well as themselves in much the same way that bread dough adheres and yet "strings out."

They are also resistant to heat and to centrifugal force, and yet have no tendency to separate or break up even under the hardest kind of rough treatment.

They are equally as capable of lubricating the ball bearings of a motor bus generator or motor, as the roller bearings of front and rear wheels, or the mechanisms of a universal joint.

They are capable of application by means of pressure lubricators or by hand; they do not drip or flow under high temperatures and they contain an oil of maximum lubricating ability, with the result that they are economical and capable of giving service for extensive periods of operation.

CONCLUSION

The failure of greases is often attributed to improper usage. More frequently, however, it will be due to improper selection.

Generally the layman is unfamiliar with the aforementioned characteristics of greases and consequently cannot understand why one grease will work and another grease of a different consistency will not.

For example, a sponge grease does not lubricate satisfactorily and the consumption is too high, so why not try a hard cup grease—it is much harder and should be satisfactory. Here no consideration is given to the texture of the grease and the melting point.

As mentioned in the discussion of grease manufacture soda soap greases have higher melting points than lime soap products and even though sponge grease is softer than a hard cup grease its melting point is higher since the former product has a soda base. Then too, the texture of the two products is entirely different, and one is soluble in water whereas the other is not. All of which indicate that greases and their field of application should be carefully scrutinized if successful grease lubrication is to be obtained.

Greases play such an important part in modern lubrication that too much time cannot be spent toward the development of higher grade products. The old method of adulterating greases with cheap fillers is obsolete. Greases of today must contain highly refined raw materials and must be skillfully made. Greases of tomorrow will depend upon chemical processes for hardening oils and upon scientific studies of fatty oils and fatty acids.

Printed in U. S. A. by
Edgar C. Ruwe Co., Inc.
72 Washington St., N. Y. C.